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	Patents ADP number *(if you know it)*	6208193006
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4.	Title of the invention	NETWORK ARRANGEMENT FOR COMMUNICATION
5.	Name of your agent *(if you have one)*	PAGE WHITE & FARRER
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NETWORK ARRANGEMENT FOR COMMUNICATION

Field of the Invention

This invention relates to a secure method and network arrangement for communication.

Background to the Invention

Subscribers of communication services on fixed or mobile networks register terminals for use within a given network with the operator of that network. The network operator can thus deliver relevant subscriber services and support call origination and delivery for that registered terminal. For example, following user registration, the network can perform connection set up, call routing and billing functions. Where a subscriber is mobile and visits another network, communication services may still be available by means of roaming agreements between the network operators.

Internet applications and particularly wireless Internet applications have been proposed which allow subscribers of secure local networks to choose between communication routes which are deemed relatively secure and alternative communication routes which are inherently less secure. The Internet is regarded as providing insecure communication routes, particularly when compared with traditional communication networks such as a fixed-cable telecommunication network or a mobile telecommunication network. Accordingly, if a terminal located in a first secure network wishes to communicate with a terminal located in a second secure network, the intermediate communication route can either be secure or insecure. For example an intermediate network such as the PSTN or ISDN networks would be deemed relatively secure. However, an intermediate network incorporating the Internet would render the communication route insecure.

Where an insecure network is used the originating and destination end terminals may use an encryption technique.

Applications for implementing the chosen encryption technique need to be provided at both the originating and destination end terminals. In practice, situations arise where a plurality of end terminals in one network wish to communicate with a plurality of end terminals in another network and mutually compatible encryption applications must be provided to each of the plurality of end terminals.

Security services employed on fixed and mobile networks include encryption, certification and authentication. Encryption, for example, typically employs systems based on key pairs. That is, before transmission a subscriber protects the transmission by running an encryption application on the originating end terminal using a key. The transfer is made with the content of the message in an encrypted (protected) format. At the destination end terminal, the message is decrypted by running a mutually compatible decryption application also with a key.

One well known type of encryption application employs a "private/public key pair system", where the originating subscriber protects his transmission using a private key and the message is then transferred via an intermediate network to an end terminal where it can be decrypted by the destination subscriber by means of a public key. This system requires that the originating subscriber makes the relevant public key available to the or each destination subscriber. Subscribers do not usually make private keys available. Options for making public keys available to destination subscribers include, for example, email or posting the key on web sites which are accessible to destination subscribers. Although the keys are available to the intended recipients, this system is inconvenient and vulnerable to those who are intent on obtaining public keys for deciphering messages not intended for them. Imitation (hoax) web sites have been used to manipulate such arrangements.

Another type of key system employed in encryption applications is the "shared secret key pair system". This system requires that the originating subscriber protects his transmission using a secret key and the terminating subscriber uses the same key (shared secret key) to extract the message information. This system differs from the private/public key pair system in that it requires that each receiving subscriber has access to the senders secret key. This arrangement is only acceptable where there is a high degree of trust between originating and receiving subscribers and secure networks therebetween.

In general, encryption techniques require that both the communicating end terminals of the subscribers have access to the relevant encryption/decryption algorithms/keys etc. The communicating end terminals must also be provided with and be able to run a suitable application. Any changes or modifications to the encryption technique at the originating end must be provided to the relevant terminal at the receiving end.

Summary of the Invention

Embodiments of the present invention seek to address the problems outlined hereinbefore.

According to an aspect of the present invention there is provided a secure network arrangement for communication between a first end terminal located in a first secure network and a second end terminal located in a second secure network, said first and second networks being separated by a relatively insecure intermediate network, the secure network arrangement including: one or more network elements triggerable to selectively route a communication from the first end terminal to the second end terminal over said relatively insecure intermediate network; and an encryption engine for encrypting said selectively routed communication before it traverses said

intermediate network, wherein said one or more network elements and said encryption engine are located substantially within said first secure network.

Preferably the one or more triggerable network elements comprise a switch means provided with a control means, and a storage means for storing routing and encryption/decryption information. The switch means can selectively route a predetermined type of communication according to routing information held in the storage means and the encryption engine is operable to encrypt said selectively routed communication according to encryption information held in said storage means.

In a preferred embodiment, said predetermined types of communication are identified by means of one or more of the following triggers set up in the switch means: recognition of originating subscriber characteristics; recognition of destination subscriber characteristics; recognition of payload characteristics or recognition of network service characteristics. Preferably, the encryption information held in the storage means defines a preferred algorithm or key for use with said predetermined types of communication. In addition, the information held in the storage means can identify one or more groups of users whose communications are to be routed and encrypted according to common preferences.

According to a second aspect of the present invention there is provided a method for secure communication between a first end terminal located in a first secure network and a second end terminal located in a second secure network, said first and second networks being separated by a relatively insecure intermediate network, the secure network arrangement including: one or more network elements triggerable to selectively route a communication from the first end terminal to the second end terminal over said relatively insecure intermediate network; and an encryption engine for encrypting

said selectively routed communication before it traverses said intermediate network, wherein said one or more network elements and said encryption engine are located substantially within the first secure network.

Brief Description of Drawings

For a better understanding of the present invention and to understand how the same may be brought into effect, reference will now be made by way of example only to the following Figures in which:

Figure 1 schematically illustrates examples of alternative communication routes between a first end terminal in a first network and a second end terminal in a second network;

Figure 2 schematically illustrates a preferred method for communication between first and second end terminals located in secure networks and separated by an insecure network;

Figure 3 schematically illustrates the method of Figure 2 applied to communication to and from a roaming mobile terminal;

Figure 4 schematically illustrates a preferred method for the distribution of encryption information; and

Figure 5 schematically illustrates a second method for the distribution of encryption information;

Description of Preferred Embodiments of the Invention

The term "encryption" used herein can refer either to direct encryption of the IP payload, possibly with addition of an encryption header, or tunnelled payloads (i.e. not only encrypting but adding a further network header to address the encrypted packets to a known tunnel end point). The term is

also used in a broader sense to refer to general compression techniques.

Figure 1 shows a first end terminal 10 wishing to communicate with a second end terminal 12. The originating end terminal 10 is in a first network (A) controlled by a first network operator and the second end terminal 12 is located in a second network (B) controlled by a second network operator. The networks (A) and (B) may be fixed or mobile networks operated by trusted network operators and are thus deemed relatively secure. The networks (A) and (B) are separated by intermediate networks which, in this example, include a public switched telephone network PSTN 16 and the Internet 22. Whereas the PSTN 16 could be regarded as a relatively secure intermediate network for transfer between the end terminals 10 and 12, the Internet 22 would be regarded as an insecure network.

Switch 14 represents a general service switching point, for example a mobile switching centre (MSC) or any suitable telecommunications switch or routing element. Communications can occur between the first end terminal 10 and the second end terminal 12 via a secure intermediate route indicated by arrows 19, shown here as via the PSTN 16. Alternatively, communication between the first and second end terminals 10 and 12 can occur via an insecure intermediate route indicated by arrows 20, shown here as including the Internet 22.

Referring now to Figure 2, a first preferred method for communication provides a secure network arrangement including a network element which permits the construction of a tunnel through the insecure network between first and second end points within the secure networks of the originating and terminating end terminals, respectively. The effect is to create a virtual private network (VPN) for secure communication between the two terminals 10 and 12. A group of logically associated intelligent network elements 30 are

provided in a secure network between the first end terminal 10 and the terminating end terminal 12. In this example, the intelligent network elements 30 are provided in the network (A) of the originating end terminal 10. The intelligent network elements 30 can communicate with end terminal 10 and also communicate with an encryption engine 40 in the first network (A).

The intelligent network elements 30 include a service switching point (SSP) 32, a service control point (SCP) 34 for providing an intelligent function, a service data base (SDB) 36 for storing subscriber profiles and an intelligent peripheral (IP) 38. The service switching point 32 can transfer messages from and/or to the first end terminal 10 and one or more of the intermediate networks 16,22. The service switching point 32 is connected to the service control point 34 which has processor functionality and access to the service database 36. The intelligent peripheral 38 is connected to the service control point 34 or possibly directly to the SSP 32.

To communicate with either of the intermediate networks, the service switching point 32 can transfer messages to and/or from either the PSTN 16 or the encryption engine 40 which defines a first end point of a tunnel 41 through the Internet 22. A further switch 18 is provided in the second network (B). The switch 18 is connected to each of the intermediate networks, namely the PSTN 16 and a second end point 42 of the Internet tunnel 41, and with the second end terminal 12. Note that the encryption engine 40 defining one end point of the tunnel 41 and the other end point 42 of the tunnel 41 are located in the first and second secure networks (A) and (B), respectively. The tunnel 41 is thus constructed as a secure passageway for transfer through the Internet 22.

The intelligent network elements 30 enable the operator of the first network (A) to offer subscribers a secure communication

route over a usually insecure network. This is achieved by intelligent management of route and encryption techniques in respect of specific subscribers or groups of subscribers. In a situation where the first end terminal 10 wishes to communicate with the second end terminal 12 via the Internet 22, the first terminal 10 originates the communication and follows call access 50 and call set-up 52 procedures. Typically the end terminal 10 transmits both an identification number and a destination number on a control channel. The service switching point 32 receives the information from terminal 10 and can refer to the service control point 34 in response to a predetermined trigger. The type of trigger employed can vary but will generally be set-up such that the intelligent network elements 30 provide the subscriber of the end terminal 10 with his preferred network service. For example, the service switching point 32 can be set up to refer to the service control point 34 in response to a trigger being set, for example, on the network address of the originating 10 or terminating 12 end terminals, on flow ID which is an identity associated with a succession of packets and/or or on payload information. In this example, the trigger is set to respond to a characteristic of the destination number. In other embodiments, the service switching point 32 may recognise a range of numbers in the originating ID number, and/or destination number or may respond to prepaid only, voice only, data only messages, and be dependent on time-of-day etc. This list of possible triggers is obviously not exhaustive.

When a referral by the service switching point 32 to the service control point 34 has been triggered as described above, the service control point 34 accesses the relevant subscriber profile stored in the service database 36. The subscriber profile contains subscriber specific information including information regarding the network services paid for by each subscriber or group of subscribers. In this example, the subscriber profile contains subscriber specific routing

and encryption information which is taken into account whenever a trigger is determined. The information stored in the service database 36 may include one or more preferred encryption algorithms (or compression algorithms etc.) and/or keys. Subscriber specific profile information is then returned to service switching point 32 via service control point 34 and the transfer is routed as appropriate. If the subscriber in question prefers communication between the first network (A) and the second network (B) to go via the PSTN 16, the profile information will indicate this and the service switching point 32 will direct the transfer accordingly. However, if the subscriber in question prefers communication between the first network (A) and the second network (B) to go via the Internet 22, then the service switching point 32 will redirect the communication to the encryption engine 40 where the message content is automatically encrypted using an algorithm. In this example, the preferred algorithm is part of the subscriber specific information specified in the service database 36. Once encrypted, the message content enters the Internet tunnel 41 where it remains in an encrypted format while it traverses the Internet, i.e. until it reaches the end point 42 located within the secure network (B).

The provision of triggered redirection and, where appropriate, automatic encryption permits a secure tunnel 41 to be constructed through the usually insecure Internet. From the end point 42 the message is routed on to switch 18 and thereafter to the destination end terminal 12. Between the end terminals 10,12 and their respective access switches (i.e. the service switching point 32 and the switch 18) in the access networks (e.g. GSM or GPRS) specific encryption or physical security is used and thereby provides inherent security within the first and second networks (A) and (B).

Any information held in the service database 36 can be easily modified or changed without down-loading or up-loading to and from end terminals 10,12. For example modifications can effect

updates of stored algorithms/keys or alter group lists to permit guest users of a subscriber to benefit from the service. The modifications may be made, for example, via an intelligent network service management access point (SMAP) which allows the operator or even the subscriber himself to change the database 36 records constituting the subscriber profile information as appropriate.

Preferred methods therefore provide a secure method of communication, wherein triggers set on say originating subscriber identity, destination subscriber number, IP address, flow ID or payload information can be mapped to intelligent network service logic available to the subscriber. Preferred arrangements in effect permit the creation of a virtual private network (VPN) for communication between the end terminals 10 and 12. Preferred arrangements represent a triggered intelligent network service on an intermediate-system (i.e. on a switch/router within a network), rather than an application based system operating on end terminals. An advantage is that the same service can be triggered for any subscriber and, if desired, the algorithms or keys used in encryption can be proprietary to a subscriber. Paying subscribers can benefit from the advantages, whether they are in home or visitor networks provided the network operators of the relevant home and visited networks are party to a roaming agreement.

Individuals or commercial entities who are subscribers and have paid for specific services will be identified in the group lists held within the service data base and can benefit from a secure network service customised according to their own preferences.

Another advantage is that commercial entities or other group subscribers can define an algorithm to be used exclusively in connections between members of a specific group. That is, company A could define an algorithm to be used in transfers

between employees of company A only; in which case when establishing a connection between company A employees, the service control point 34 would inform the service switching point 32 to forward an encryption algorithm specific to company A to the encryption engine 40.

Another advantage is that because handling of encryption is in fact network based there is no need to store encryption or compression algorithms or the like at either of the respective end terminals 10,12.

Intelligent network elements 30 can cause encryption keys or even encryption algorithms themselves to be loaded and used at encryption end points associated with the service switching point 32. The encryption engine 40 may, but does not need to be, part of the intelligent network elements 30 served directly by the service switching point 32 which triggers the service. For example, the triggering service switching point 32 may simply redirect packets or flows of a specific subscriber to an encryption engine 40 on a separate network/sub-network, by re-routing to the relevant host in order to enter the encryption engine 40. Of course, a decryption point would still need to be located at the end point 42 or at least within the secure network (B).

In one modified version the algorithm is run in a centralised encryption (or compression etc) network element (NE) separate from the service switching point 32 but still within the first network (A). In this case, the service control point 34 returns routing instructions (e.g. a tunnel to the NE) and any encryption parameters to be used in the encryption NE. Corresponding means may be provided within the second network (B) to effect decryption/de-compression of the message.

In another modified version, the service is triggered in response to a specific message sent by the source terminal. That is, the service is specifically commanded by the end

terminal in communication.

In another modified version, the service switching point 32 may refer to the service control point 34 as a matter of course. (i.e. without a trigger being recognised). The records in the service data base then being accessed by the service control point 34 to determine specific routing instructions and encryption/decryption information.

Where roaming agreements are in place between the operators of networks (A) and (B), corresponding secure network services can be provided on service switching points in the visited network. These service switching points may run algorithms set up in advance through agreement between the network operators or transferred dynamically, for example upon an end terminal attaching to a visited network. Alternatively, distribution of the necessary encryption/decryption information may be achieved via a secure virtual home environment (VHE) mechanism or by a distribution method/arrangement described hereinafter.

Figure 3 shows how a roaming agreement set up between the operators of networks (A) and (B) may allow originating end terminal 10 to benefit from the advantages of the preferred method while visiting network (B). End terminal 10 in effect experiences a virtual home environment (VHE) facilitated by secure communications between the network operators party to the agreement. The virtual home environment enables terminal 10 to initiate the normal access 50 and connection set up 52 operations as if it was located in its home network. If the subscriber of end terminal 10 normally benefits from secure network communications provided by his home network operator, a trigger set up using intelligent network elements 60, as mentioned above will be identified in the service switching point 62. If no such trigger is identified the service switching point will route the call via the PSTN 16 or via the Internet 22 non securely. Where a trigger is identified by the service switching point 62, the service control point 64

accesses the service database 66 in which the subscriber profile contains encryption information. According to the profile information contained in service database 36, in this example routing information, encryption information and group subscriber lists, etc., the service control point 64 controls the service switching point 62 to redirect the call in a secure manner via the Internet 22. As before, the message would be then redirected to an encryption engine 80 where the message is encrypted before it enters a tunnel 41 for secure transfer through the Internet 22 to a secure end point 82 within the destination network (A). From this end point 82, the call is routed via the switch 14 to the destination end terminal 12. Triggers are available not only in the originating network on messages from the source terminal but also in the destination network on messages intended for the destination terminal.

The above type of secure service can be made available anywhere in the world provided subscribers are visiting areas covered by roaming agreements with their home network operator. These services can be run from any terminal because the manner of operation means they are actually effected on the network. All of the earlier mentioned advantages apply to such roaming methods.

In order for originating and terminating end points to decipher encrypted (or compressed) data, they must have access to the relevant decryption (or de-compression) algorithms and/or keys and be able to run them. In the cases of the methods of Figures 2 and 3, the encryption end points 40,80 and 42,82 need to be provided with the relevant encryption/decryption information. It is desired that only those for whom the message is intended can access the algorithms and/or keys which enable the message to be deciphered. Moreover, these keys should not be distributed over insecure networks. Where transmission of decryption information is unavoidable, it should be distributed over

networks in a secure manner.

Two trusted network operators such as the operators of the first and second networks (A) and (B) would normally have access to corresponding encryption/decryption keys. Nevertheless, the subscriber may still prefer to pay extra for specific algorithm services which in effect function as an additional layer of encryption or represent a specific tunnel construction. In addition to the Internet 22, insecure intermediate networks may include fixed and mobile networks over which the network operator cannot offer the standard of encryption required. Where this situation occurs, security beyond the basic ciphering provided in for example GSM networks (and future UMTS networks) may be required by network users. When such additional protection is required, the destination end point 42 and/or the destination end terminal 12 must have access to the necessary decryption information which is typically an algorithm or a key. The intelligent triggered method of Figure 4 works by querying a security server connected in an intelligent network as an intelligent peripheral as described below.

Figure 4 schematically shows a preferred method for the distribution of encryption/decryption information. The illustrated network uses an algorithm/key distribution system managed by intelligent network elements 30. The arrangement of Fig. 4 is similar to that of Fig. 2 and like reference numerals indicate like features. A first end terminal 10 wishes to communicate with a second end terminal 12 in a secure manner. The originating end terminal 10 is in a first network (A) controlled by a first network operator and the second end terminal 12 is located in a second network (B) controlled by a second network operator. The networks (A) and (B) may be fixed or mobile networks operated by trusted network operators and are thus deemed relatively secure. In order for the message content to traverse the Internet 22 in a secure manner it will need to be encrypted at or before the

tunnel end point defined by encryption engine 40 and decrypted at or once it has passed end point 42. Thus it is possible for encryption/decryption to occur at nodes within either of the networks (A) and (B) (e.g. encryption engine 40 or end point 42). Alternatively, it is possible for encryption/decryption to occur at the end terminals 10,12, respectively.

In operation, the end terminal 10 goes through the attach 50 and connection set up 52 procedures which inevitably depend on the type of network. Service switching point 32 handles the request for communication and, if present, a trigger causes the service switching point 32 to refer to the service control point 34. Examples of the various types of trigger set-up available were mentioned earlier with reference to Figures 2 and 3. The SCP 34 provides an intelligent function and can refer to a subscriber profile in the service database 36. The subscriber profile provides subscriber specific encryption information and may also provide routing preferences. The service control point 34 then communicates with the service switching point 32 to route the transfer either through the PSTN 16 or via the Internet 22. Where the subscriber profile in service database 36 specifies encryption, the message is routed to the encryption engine 40 and onwards to switch 18 via the Internet 22. There is a corresponding end point 42 where the message is decrypted within the secure network (B). It would of course be possible for the relevant decryption to be performed at the end terminal 12.

An intelligent network service management access point (SMAP) 100 allows the operator to alter records in the database 36 and, therefore, specify, load and change the algorithms or keys to be stored and/or distributed. Accordingly, a given subscriber can manage his own key hierarchy by instructing the network operator to make, delete or alter relevant entries in the database 36.

Note that the network (A) includes intelligent network elements 30 and the service database 36 containing security information managed by the operator of network (A). An intelligent peripheral could also hold security information for example, keys. The security information stored in service database 36 might include encryption algorithms, compression algorithms, keys 39 etc. As before, where this security information is held within or is associated with a given subscriber profile, it can be proprietary to a specific subscriber. A selection of different algorithms or keys may be held in association with a specific group of subscribers. More than one algorithm/key may be stored in the service database 36 with the various items being held in a hierarchy along with specific instructions for use thereof.

Preferred network arrangements can be set up to automatically communicate the particulars of encryption or indeed whether or not encryption is required at all. Preferred networks can be set up to ensure decryption algorithm/keys are received by the or each destination end terminal, either at the same time or at a different time to the message itself. That is, any one who was targeted as a recipient of a message can automatically receive the relevant decryption information. As before, the effect is to create a virtual private network between communicating end terminals.

Where a message is a broadcast message intended for a target group consisting of a number of end terminals 12, a plurality of keys 39 can be distributed simultaneously for the plurality of target end terminals 12. Since the second network (B) is deemed to be secure, it is not necessary for terminating end terminals 10,12 to run decryption applications nor handle any type of algorithm/keys at all. Encryption or decryption can be performed at any secure points within networks (A) and (B) under the control of the intelligent functions as described with reference to Figures 2 and 3. However, in certain circumstances it may be that distribution of decryption

information for example keys to end terminals is preferred and this is also possible provided the or each end terminal in question is provided with the means necessary to run the decryption application. The distribution of a key need not be triggered specifically by a message content associated with a call. The intelligent network may, for example, periodically distribute keys to selected end points or end terminals or in response to external events. Thus with a preferred network incorporating an intelligent network function for the distribution of encryption information, keys can be distributed for any party attached to any point in the network and the distribution process can be network initiated. That is network-initiated key up dates can be propagated to secure end points 42 within the destination network or directly to end terminals 12 of subscribers between sessions or calls. The network-initiated update may be to the or each user selectively or it may be to one or more of the operators and the distribution thereafter managed by the operator. Similarly, any modifications or changes to algorithms/keys or the key hierarchy can be specified and transmitted to destination nodes with great efficiency.

The timings of network-initiated key distributions can be selected to maximise security. For example, the keys may not be distributed simultaneously with the messages they may be distributed at different predetermined times which may be regular or irregular times. All of the above services would be available on a fixed network or on a mobile network and in the latter case switching on or moving, for example, may be used as triggers to push encryption information updates around the various networks.

In mobile networks where the originating and/or terminating end terminal is visiting another operator's network, the service may be offered in accordance with roaming agreements. Preferably, trusted communications between reputable network operators will permit a virtual home environment (VHE) to be

provided to visiting mobile terminals and, therefore, a subscriber could have access to the service anywhere in the world provided the local network is party to such an agreement. A virtual home environment is facilitated when information concerning all aspects of the service possibly including encryption/decryption information, is shared between network operators in a secure manner.

Recipient end terminal users can specify that they wish to answer calls only according to certain circumstances. For example, they may choose not to answer any calls which are not accompanied by keys or for which they do not have access to keys.

Public keys can be securely distributed to target subscribers over usually insecure intermediate networks for use with a private key service held at a secure location within one of networks (A) or (B). Alternatively, private keys may be distributed specifically to the service subscriber for him to use exclusively in signing certificates or data. This service has obvious advantages over a system in which keys are distributed in a non-specific manner.

Signed certificate data can be verified by the public key distributed to other parties needing authentication of the sender. Where public keys are made available by general broadcast or held at specific sites it is desirable for the validity of the key to be certified by some authority. Network operators may authenticate signed data/keys that is, act as a Certification Authority and, where appropriate, charge for the service.

In cases of secure symmetric encryption, a shared (secret) key can be distributed for secure sessions between two or more end terminals 10,12 wishing to form secure connections across one or more usually insecure networks. Secure encryption techniques are possible because the intelligent network

elements 30 and particularly the tunnel entry 40 and tunnel exit 42 end points are located within networks owned by trusted network operators using network specific (e.g. GPRS or GMS) encryption.

The intelligent network function for the distribution of encryption information may be provided in originating network (A) or terminating network (B). In fact, one or more intelligent network elements may be provided in both ends of the communication chain. Figure 5 shows an arrangement in which intelligent network elements 60 are provided at the destination end of the communication chain. In order to communicate a message, the end terminal 10 would go through the usual access 50 and connection set up 52 procedures, regardless of whether the switch 14 in network (A) is in fact a telecommunication switch, an MSC or a type of intelligent network element. Assume also that switch 14 is operable to direct the transfer via the Internet 22 in an encrypted form. The message would thus be routed to a first tunnel end point, in this case defined by encryption engine 40. The exit to the tunnel 41 is defined by a second tunnel end point 42 from where the message is routed to intelligent network elements 60.

When the message reaches the group of intelligent network elements 60 it is received by service switching point 62. If a trigger has been set up and is identified, the service switching point 62 refers to the service control point 64. SCP 64 provides an intelligent function and accesses the service database 66 to get information on the algorithm or key relevant to the message in question. Information in the service database 66 can be associated with the message by any suitable means, e.g. by the ID of the originating subscriber or the destination number. In fact, the trigger may operate in response to any address message, ID, IP address, flow ID or payload information etc. The relevant encryption information, in this case key 69, is transmitted back to the service

control point 64 and then on to the service switching point 62 for transfer directly to the destination end terminal 12.

All advantages described in relation to the method of Figure 4 also apply here. For example, subscribers are able to control and manage their own key hierarchy in the same way as described with reference to Figure 4.

Clearly, the or each group of intelligent network elements 30,60 providing the triggering and distribution functions can be positioned at any convenient point in the communication chain, provided that the chosen location is one within the secure networks. Further, the elements of the or each group of elements 30,60 providing the trigger (recognition) and distribution functions, namely the service switching points 32,62 and the service control points 34,64 need not be in the same part of the distribution chain. That is, a first group of intelligent network elements 30 in network (A) can instruct a second group of intelligent network elements 60 in network (B) to distribute a key (or algorithm) to one or more destination end terminals 12.

Where added encryption is required on usually secure networks (e.g. PSTN 16), it is possible to provide an arrangement wherein the necessary encryption/decryption means 40,42 are provided in the communication chain at either end of the PSTN 16 network or on the end terminals 10,12.

Short message services (SMS) could be used to deliver keys. However, under short message service conditions nothing would be automatic, i.e. the key would not necessarily be received when the call is received in which case it would need to be requested subsequently. Short message service delivery may not always be possible if the receiving party is analogue mobile or fixed telephone. Preferred embodiments are therefore most effective when used with fixed or mobile terminals whereas GSM mobile has the additional option of SMS services.

Under certain circumstances, it may be preferable for the security information such as keys to be delivered on control channels rather than on user channels.

The schematic illustrations of preferred embodiments are not intended to limit the invention to one or more of the specific arrangements disclosed herein. For example, the or each of the network elements for performing the invention may be provided in any suitable arrangement(s) and one or more is likely be provided in different hierarchical layers of the relevant telecommunication network.

CLAIMS:

1. A secure network arrangement for communication between a first end terminal located in a first secure network and a second end terminal located in a second secure network, said first and second networks being separated by a relatively insecure intermediate network, the secure network arrangement including:

one or more network elements triggerable to selectively route a communication from the first end terminal to the second end terminal over said relatively insecure intermediate network; and

an encryption engine for encrypting said selectively routed communication before it traverses said intermediate network,

wherein said one or more network elements and said encryption engine are located substantially within said first secure network.

2. A secure network arrangement according to claim 1, wherein said one or more network elements comprise a switch means provided with a control means and a storage means for storing routing and encryption/decryption information.

3. A secure network arrangement according to claim 2, wherein the switch means is operable selectively route a predetermined type of communication according to routing information held in the storage means and the encryption engine is operable encrypt said selectively routed communication according to encryption information held in said storage means.

4. A secure network arrangement according to claim 3, wherein said predetermined types of communication are identified by means of one or more of the following: originating subscriber characteristics; destination subscriber characteristics; payload characteristics or network service characteristics.

5. A secure network arrangement according to claim 4, wherein said predetermined types of communication are identified by means of the originating or destination address.

6. A secure network arrangement according to claim 4, wherein said predetermined types of communication are identified by means of originating identification or destination numbers.

7. A secure network arrangement according to claim 2, wherein the routing information and encryption/decryption information specifies operations according to subscriber preferences.

8. A secure network arrangement according to claim 7, wherein the encryption/decryption information defines a preferred algorithm or key for use with said predetermined types of communication.

9. A secure network arrangement according to claim 2, wherein the information held in the storage means identifies one or more groups of users whose communications are to be routed and encrypted according to common preferences.

10. A secure network arrangement according to any preceding claim, comprising a service management access point for accessing and changing information held in the storage means.

11. A secure network arrangement for communication between a first end terminal located in a first secure network and a second end terminal located in a second secure network, said first and second networks being separated by one or more intermediate networks at least one communication route through which constitutes a relatively insecure communication route from the first end terminal to the second end terminal, the secure network arrangement including one or more network elements triggerable to selectively route a communication from

the first end terminal to the second end terminal over said relatively insecure intermediate network; and

an encryption engine for encrypting said selectively routed communication before it traverses said interemediate network, wherein said one or more network elements and said encryption engine are located substantially within said first secure network.

12. A secure network arrangement according to any preceding claim, including decryption means located substantially within the second secure network.

13. A secure network arrangement according to claim 12, wherein said decryption means are provided at the second end terminal.

14. A secure network arrangement according to claim 12, wherein said decryption means are provided at a node other than the second end terminal.

15. A method for secure communication between a first end terminal located in a first secure network and a second end terminal located in a second secure network, said first and second networks being separated by a relatively insecure intermediate network, the method including the steps of providing:

one or more network elements triggerable to selectively route a communication from the first end terminal to the second end terminal over said relatively insecure intermediate network; and

an encryption engine for encrypting said selectively routed communication before it traverses said intermediate network,

wherein said one or more network elements and said encryption engine are located substantially within said first secure network.

16. A method according to claim 12, wherein said one or

more network elements is provided with means to store decryption information and is triggerable to distribute the decryption information to one or more target nodes in the second secure network.

17. A method according to claim 15, wherein there is further provided in said second secure network one or more network elements operable to store encryption/decryption information and triggerable to distribute the encryption/decryption information to one or more target nodes in the second secure network.

18. A method according to any one of claims 15-17 provided to a subscriber located in a visited network by virtue of a roaming agreement.

19. A method according to any one of claims 15-18, wherein there is provided decryption means located substantially in said second network.

20. A method according to claim 19, wherein the decryption means is provided at a node other than the second end terminal.

21. A method according to claim 19, wherein the decryption means is provided at the second end terminal.

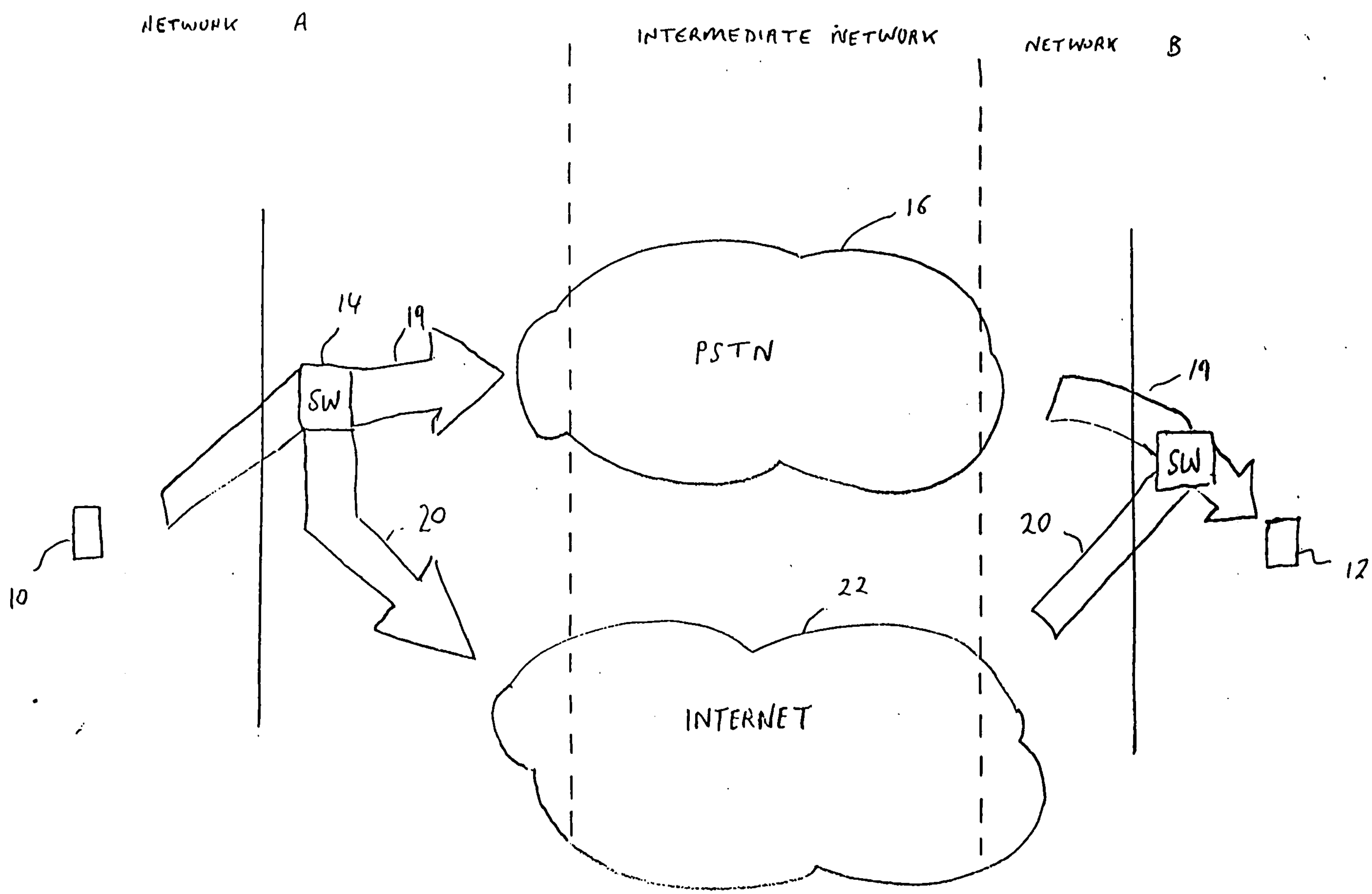
NETWORK A
INTERMEDIATE NETWORK
NETWORK B
SW
SW
PSTN
INTERNET
10
12
14
16
19
19
20
20
22

Fig. 1

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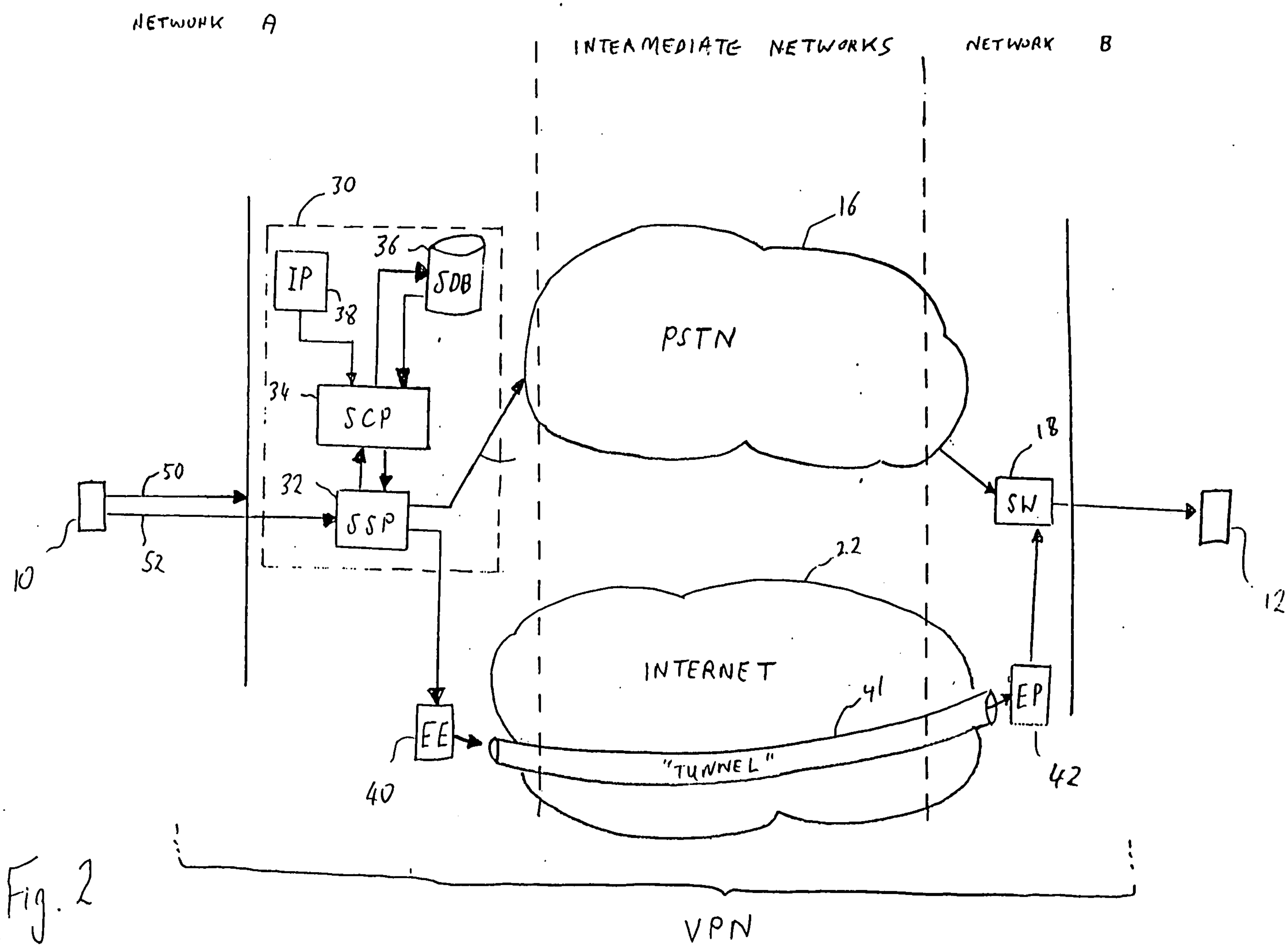


NETWORK A
INTERMEDIATE NETWORKS
NETWORK B
30
IP
38
36
SDB
34
SCP
32
SSP
50
52
10
PSTN
16
18
SW
12
2.2
INTERNET
41
EE
EP
"TUNNEL"
40
42
VPN

Fig. 2

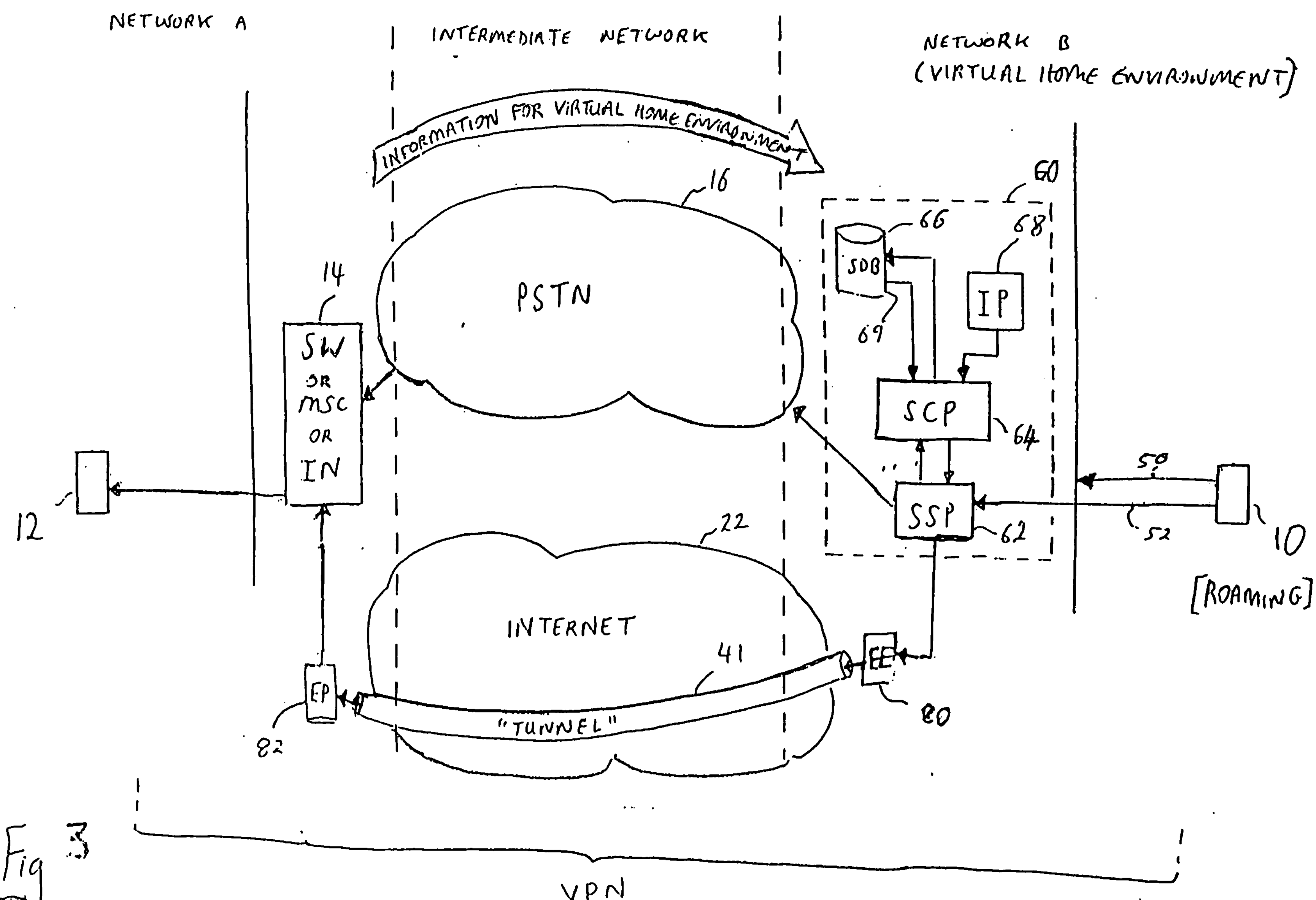
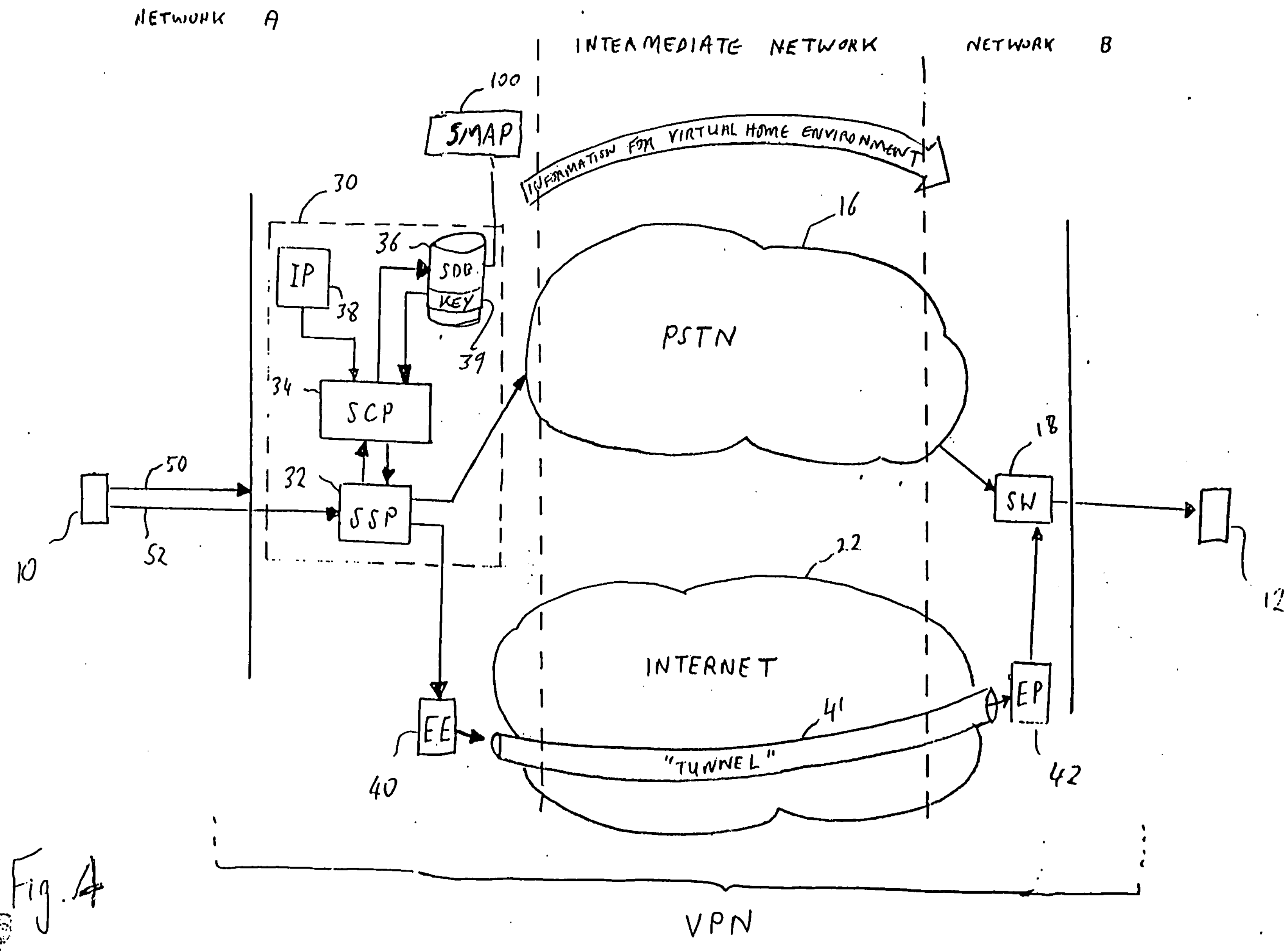

NETWORK A
INTERMEDIATE NETWORK
NETWORK B
(VIRTUAL HOME ENVIRONMENT)
INFORMATION FOR VIRTUAL HOME ENVIRONMENT
16
PSTN
14
SW OR MSC OR IN
12
60
66
68
SDB
IP
69
SCP
64
SSP
62
50
52
10
[ROAMING]
22
INTERNET
41
EE
80
EP
82
"TUNNEL"
VPN

Fig 3



NETWORK A
INTERMEDIATE NETWORK
NETWORK B
100
SMAP
INFORMATION FOR VIRTUAL HOME ENVIRONMENT
30
36
SDB
KEY
IP
38
39
34
SCP
32
SSP
50
52
10
16
PSTN
18
SW
12
22
INTERNET
41
"TUNNEL"
EE
40
EP
42
VPN

Fig. 4

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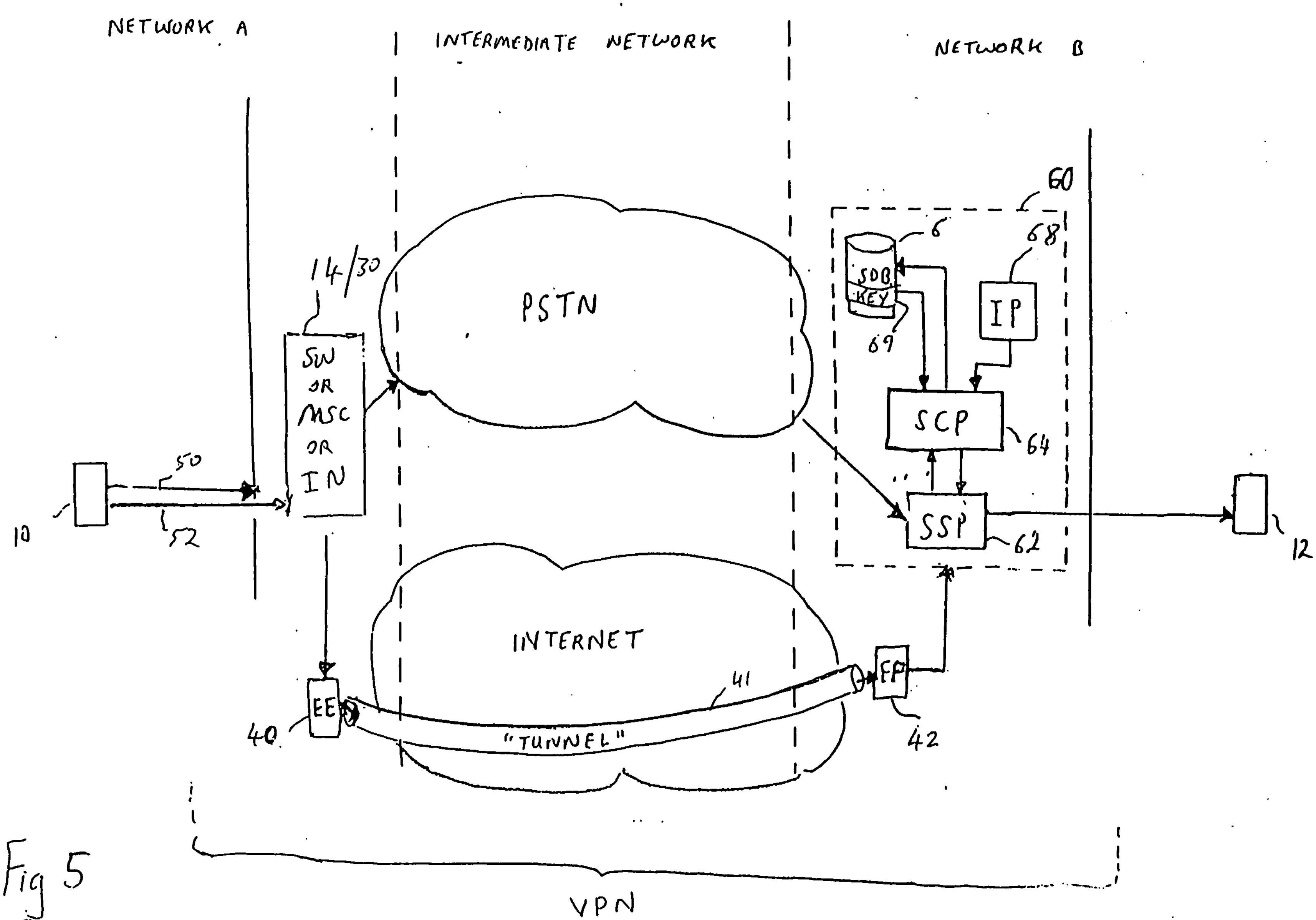

NETWORK A
INTERMEDIATE NETWORK
NETWORK B
SW OR MSC OR IN
14/30
10
50
52
PSTN
INTERNET
"TUNNEL"
41
EE
40
FP
42
SDB
KEY
6
69
IP
68
SCP
64
SSP
62
60
12
VPN

Fig 5